

Cosmos, Time and Creation

Remarks to the Philosophical, Theological and Physical Conceptions of Creation

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Abstract

The concept of the beginning of Cosmos appears to be problematic. Not only ancient theological, but also present-day physical approaches evoke many questions. They originate in the definition of time, its dimensionality and its scale. If we accept the Standard Model, all physical processes including processes utilised in clocks (chronometric processes) lose their theoretical basis in the vicinity of the initial singularity. The singularity is hidden behind horizon. Does it mean that the singularity did not exist?

Keywords: Big Bang, creation, cosmos, time scale, imaginary time, horizon, singularity.

LIKE THE TAO,
THE INDEFINITE THAT CAN BE NAMED
IS NOT THE TRUE INDEFINITE.

1 Ancient theological and philosophical approaches

Every mortal has been born, every particular thing emerged at a certain moment in the past. However, can the concept of the beginning also be applied to the whole Universe? And can it be applied on time itself? Among the variety of theological and scientific theses that have appeared during history, we can find both positive and negative answers. The weightiest argument is perhaps that “Nothing can emerge from nothing”. This thesis comes from experience with the “ordinary world” and can be understood as an intuitively and vaguely formulated conservation law. Creation and annihilation would therefore be impossible. From this rule, many concepts of an eternal (and usually also static) Universe have been developed, e.g. the models of Aristotle, of the Epicureans, and also most of the modern concepts valid until the middle of the 20th century.

Cosmological (rather cosmogonical) conceptions point to a fundamental problem, to the definition of the very concept of “beginning”, “genesis”, “creation” or “emergence”. What do these words mean? I want to stress that they denote not only “coming out from pure nothingness”, but also “rising up from something different by adding some new quality”. Addition of a new quality means formation, ordering, organising — for example, condensation of a new phase in some physical system or some (re)structuring. The Greek term for order was Cos-

mos. From the time of the Pythagoreans this term has also labelled the Wholeness, the Universe, the world. The reason was that the Pythagoreans recognised and realised the order which governs the whole. (However, the idea of mathematical order in the Universe is much older. It was common already in ancient Egypt, in the Old kingdom.) So the emergence of Cosmos can mean the ordering of the initial state — Chaos. Such conceptions were widely spread during antiquity. We can find them e.g., in Egyptian and Greek mythology, and also in many philosophical approaches. For example, according to Anaxagoras the initial Chaos was ordered by a supernatural agent called Nous. And, according to Plato, Cosmos was arranged from the original Chaos by the ordering activity of “god” Demiurgos (“skilled worker”). [1] The Stoics believed in the rise of Cosmos from Fire, i.e. from an unorganised hot state of matter. Fire was part of the whole universal cosmic cycle — Ekyphrosis.

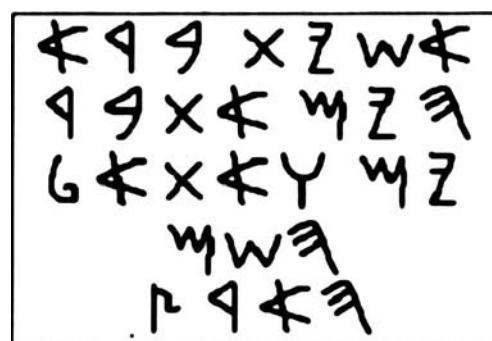


Fig. 1: First words of Genesis (in old Hebrew)

1.1 Creation and the Book of Genesis

Did the Christian God also create the world by ordering? What does the Holy Scripture describe? The traditional interpretations say that God created the Universe from nothing. However in the Book of Genesis is written:

IN THE BEGINNING GOD CREATED
THE HEAVEN AND THE EARTH... [2]

So, it is not stated that God created the Wholeness, the Universe itself. (However, old Hebrew had not terms for abstracts.) And it is not even explicitly stated that Creation was made from pure nothingness. The creative activities of the Christian God and of Plato's Demiurgos need not be principally in contradiction.

1.2 Approaches of Augustine and Thomas Aquinas

NON EST MUNDUS FACTUS IN TEMPORE,
SED CUM TEMPORE.

Augustinus Aurelius

In the 5th century, St. Augustine formulated idea that God created time together with the world. However, this assertion could appear paradoxical even from his own viewpoint. "Creation" is, as a rule, regarded as an activity taking place in time, therefore it cannot be related to time itself. (It was Augustine himself who stressed that, in all our expressions, "time" or temporal information is implicitly hidden in the grammar, and this "grammatical time" could contradict explicit formulated assertions about time. "Creation of time" is a self-referring concept, self contradictory which from logical viewpoint must be eliminated.) How can this paradox be solved?

One possible answer can be found in the *Summa Theologica* by St. Thomas Aquinas (13th century). [4] Thomas distinguished between creation understood philosophically (metaphysically), with no reference to (ordinarily understood) temporality, and creation understood theologically (and also ordinarily, physically). He concluded that God created the world in the philosophical meaning of the time; creation is not any change, no ordering, nor an act in time. It represents continual activity (continual in ordinary time), a process causing the existence of whatever is. Without this activity all things would disappear. (So "God" is an answer to the question: "Why is there something and not nothing?") Creation and eternality are thus not in contradiction, God could create even an eternal world if he wanted to do so. (Through these considerations Thomas believed in a temporally limited world.) [3]

Can these ideas be reflected in the framework of present-day science? Thomas' conceptions can easily be described by two-dimensional time. One coordinate is ordinary (physical, or "theological" in Thomas's terminology) time. In this dimension all physical and human processes take place, and in this dimension the Big Bang also took place (as a singularity in the standard cosmology). The other perpendicular coordinate represents "divine", metaphysical or imaginary time ("philosophical") in which God created our Cosmos with its whole history. I am aware that the introduction of a "divine quality", i.e., a quality without a clear relation to observable physical entities, may be unacceptable to most scientists. On the other hand, complex, i.e. two dimensional, time with one real and one imaginary ("divine") coordinate, has also been introduced by modern cosmology. [5] So imaginary coordinates not only solve (or rather describe) the "mystery of Creation", but also help present-day cosmologies to understand the mystery of singularity, the Big Bang. In this way modern cosmology returns back to forgotten ancient conceptions. However, there remain many doubts: Does "complex time" play any role in "ordinary" physics, or is it only a "deus ex machina", rescuing physicists from troubles of the singularity?

2 Physics of Time

The term "time" has many meanings, but we will limit only to the "physical time" here.

Time has qualitative and quantitative aspects. Its (local) quantitative aspect is represented by its scale. The theoretical and practical realization of the time scale is an issue in physics, because scales are determined by a physical realization of time units. However, the choice of a "proper" scale belongs rather to metaphysics.

In early times people used astronomical scales based on the rotation of the Earth and its motion around the Sun. A range of sundials were constructed. Afterwards, clocks were developed, utilising various chronometric processes: the motion of sand or water in hourglasses and clepsydras, the oscillation of a balance wheel, pendulums, the oscillation of the photons emitted by an energy jump in a specific atom (atomic clocks), etc. There was an effort to use scales which are mutually interconnected ("solidary scales"). When a new "better" clock (and a "better" scale) was introduced, it had to offer a better approach to some "ideal scale", "ideal time". However, the "ideal scale" itself is unattainable in practices. It is something like a Platonic idea. So the practical criterion has been only "mutual solidarity" of clocks; all clocks have to exhibit the same time, or their individual times have to be linearly dependent. Continual improvements of clocks (scales) en-

able slighter and slighter physical phenomena to be measured, including the irregularities of the phenomena (chronometric processes) that had made an earlier clock “worse” — non-uniformity of the rotation of the Earth, non-homogeneity of the gravitational field, etc. Mutual solidarity of clocks has led to the practical definition of the timescale till today: “official time” is defined as the weighted average of the times of certain representative precise clocks (now atomic clocks).

Temporal scales are in practise realized by clocks (supplemented by calendars). Clocks perform some physical chronometric process, and some measuring instrument of the characteristics of the chronometric process. The chronometric process is usually periodical processes, the measuring instrument being a counter of periods (i.e. memory) and sometimes also a tool for measuring the phases of the period (with some important exceptions, of course, e.g. measuring elapsed time by the decay of radioactive nuclei — the C14 method, geological methods, measuring of the age of the Universe by its expansion, etc.). The realization of the chronometric process requires the validity of the whole chain of physical laws, the most general being perhaps the energy conservation law. However, the dependence is mutual. We can say that only a certain class of (linearly dependent) timescales guarantees the conservation of energy (and other physical laws).

An interesting attempt to solve cosmological problems by introducing a slightly varied timescale was made in the mid 20th century by E. A. Milne. In addition to the ordinary “atomic time” scale, Milne introduced another “cosmological” time scale, which was (very slightly) nonlinearly dependent on the atomic scale. The divergences between these scales were not observable in practice, but the effect was such that the age of the Universe in “cosmological” time was infinite. [6]

3 Metaphysics of Time Scale

As I have mentioned, the choice of a chronometric process and the (physical) law describing this process is principally arbitrary. As has been stressed by Henri Poincaré, the only criterion for “reasonable choice” is the demand for simplicity of physical laws (i.e. also simplicity of the description of most processes around us [7]). Nevertheless, there arises a fundamental problem: how can we define a time scale in situations when no clocks are available? Naturally, we could extrapolate the validity of our physical laws, i.e. “extrapolate the existence of clocks”. Most of us believe that our physics describes all natural (physical) phenomena, not only here and now. (This assumption has been an extremely fruitful epistemological tool throughout the history of science. This

belief is also supported by astronomers, who observe events at great spatial and temporal distances. So, where is the problem?

I consider there could be serious trouble with extrapolation of time — i.e. the scale of time — to the very beginning, to the Big Bang or to Creation, if you want. Any extrapolation is a risky business when we extrapolate to a quite unknown situation. This is the situation of the very beginning of our Cosmos. It seems evident that there were no rigid bodies, no oscillators based on them (pendulums, crystals, etc.), there were no bodies bounded by simple gravitational interaction, there were no atoms with electron shells, etc. There was nothing from which “reasonable clocks” could be constructed. The conditions were so extraordinary that they cannot be described even by (present-day) physics. (Was it still natural, or was it a supernatural state of affairs?) And, even worse, the most general framework for all chronometric processes — the energy conservation law — was also deconstructed here. (See problems with the definition of energy in general relativity or in theories concerning the Higgs field and “false vacua”).

If we accept the standard cosmological model, we have no way to extrapolate our time scale to the very beginning, to the starting point, to Creation. Our physics (and whole scientific approach) is confined by a horizon which can be approached but never reached or even exceeded. We can introduce various time scales, but no timescale can be “physically” extrapolated across the horizon. Time is represented by an open set, a set without the first point. Similar situation concerns spatial scale. (Definition of meter is interconnected with definition of second through a constant, speed of light.) So the deconstruction refers to the whole concept of space-time. The horizon is an epistemological horizon, a horizon of physics itself. It separates the (principally) known from the (principally) unknown, physics from metaphysics, Cosmos from Chaos, natural from supernatural. Does the horizon also represent an ontological boundary?

4 Conclusion

My short theorization implies that the very concept of a beginning of the Universe (in the framework of the Standard Model) lacks a physical foundation. It is also the reason why we cannot extrapolate our temporal scale to the very beginning. The concept of the age of the Universe therefore also remains unspecified.

References

- [1] Plato: *Timaeus and Critias*, Czech edition *Timaios a Kritias*, Oikoymenh, 2nd edition, Praha 1996.

- [2] *King James Bible*, Old Testament, The First Book of Moses, called Genesis.
- [3] Carroll, W. E.: *Time and Creation: Thomas Aquinas and Contemporary Cosmology*, a paper for the international conference 1609–2009 From Galilei's Telescope to Evolutionary Cosmology, Pontifical Lateran University, Vatican City, November 29th–December 2nd, 2009 (to be published).
- [4] Aquinas, T.: *Summa theologica I*, 46, article 3, <http://www.ccel.org/ccel/aquinas/summa.html>
- [5] Hawking, S.: *A Brief History of Time: From the Big Bang to Black Holes*, Bantam Books Inc, New York, 1988.
- [6] Milne, E. A.: *Kinematic Relativity*, Clarendon Press, Oxford, 1948.
- [7] Poincaré, H.: La mesure du temps, in *Revue metaphysique et morale*, 6, 1898, p. 1–13.

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